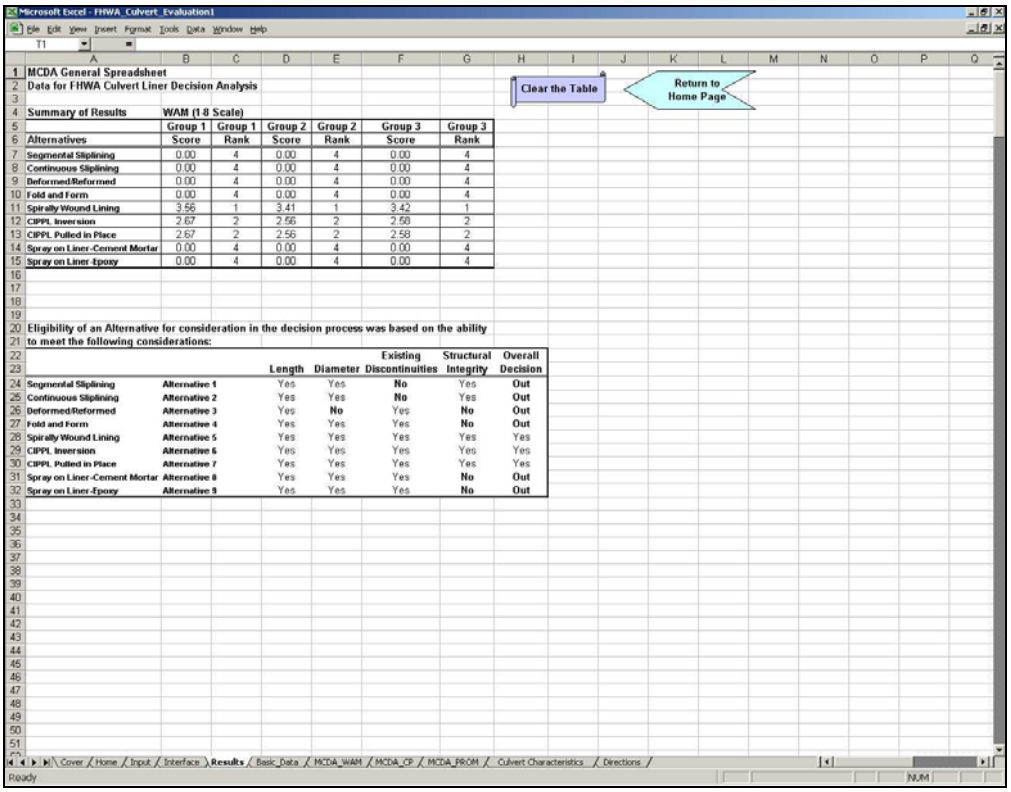


**Figure 41. Screenshot. Results of the Coquitlam Case Study Decision Analysis.**

According to Figure 41, the highest rated alternative in all three (3) scenarios is spirally wound lining and the second rated alternative was consistently cured-in-place lining inversion method and cured-in-place lining pulled-in-place method. Numerical weights for the alternatives included in the model can be found on the Basic Data worksheet. Comparison of the three (3) methods on the Basic Data worksheet shows that spirally wound lining is better weighted for cost, environmental concerns, flow bypass requirements, digging requirements, and time required for installation. Weights were equal for the three (3) methods for safety considerations, abrasion and corrosion resistance, and potential capacity reduction after installation of the liner. Cured-in-place lining inversion method and cured-in-place lining pulled-in-place method were better weighted than spirally wound lining for design life. Figure 42 presents the Basic Data worksheet.

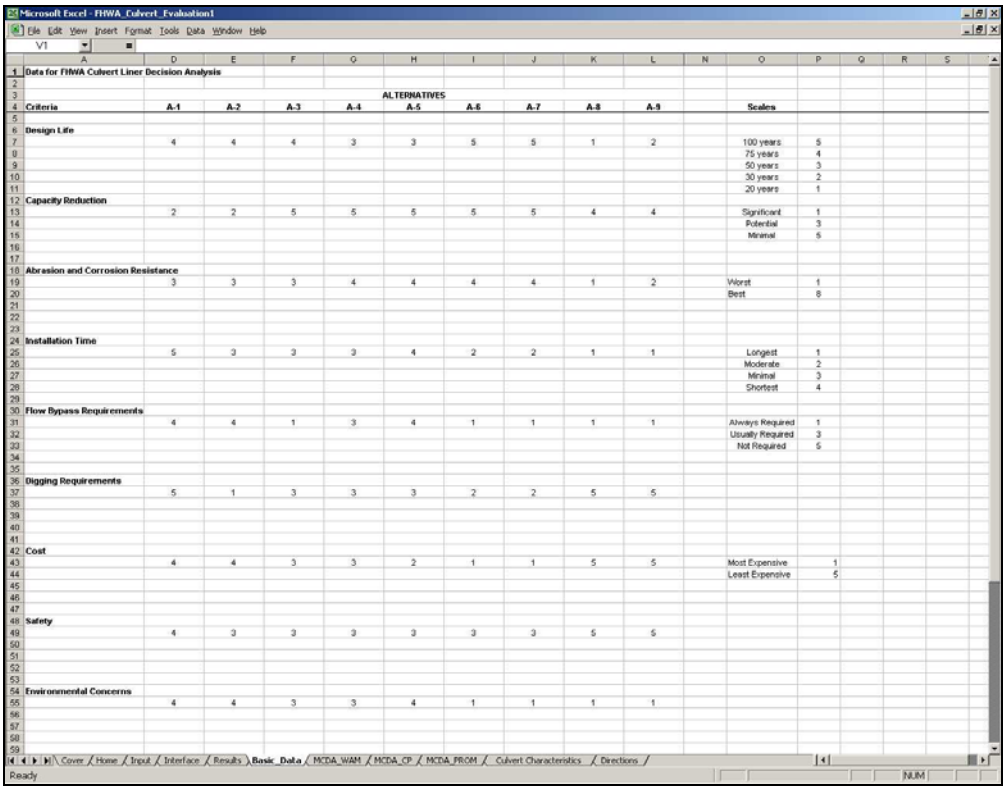


**Figure 42. Screenshot. Basic Data Worksheet.**

## Comparison of Methods of Alternative Ranking

Ranking of alternatives in the previous example were determined by the Weighted Average Method. As previously described, two (2) other methods of alternative ranking are available, CP and PROMETHEE. Table 52, Table 53, and Table 54 provide a comparison of the results originated from the three (3) alternative ranking methods for the Coquitlam case study example.

## Table 52. Weighted Average Method.

| Summary of Results | WAM (1-8 Scale) |
|---|---|

| Alternatives | Group 1 Score | Group 1 Rank | Group 2 Score | Group 2 Rank | Group 3 Score | Group 3 Rank |
|---|---|---|---|---|---|---|
| Segmental Sliplining | 0.00 | 4 | 0.00 | 4 | 0.00 | 4 |
| Continuous Sliplining | 0.00 | 4 | 0.00 | 4 | 0.00 | 4 |
| Close-fit lining Deformed/Reformed | 0.00 | 4 | 0.00 | 4 | 0.00 | 4 |
| Close-fit lining Fold and Form | 0.00 | 4 | 0.00 | 4 | 0.00 | 4 |
| Spirally wound lining | 3.56 | 1 | 3.41 | 1 | 3.42 | 1 |
| Cured-in-place lining Inversion | 2.67 | 2 | 2.56 | 2 | 2.58 | 2 |
| Cured-in-place lining Pulled-in-place | 2.67 | 2 | 2.56 | 2 | 2.58 | 2 |
| Cement-mortar Spray-on lining | 0.00 | 4 | 0.00 | 4 | 0.00 | 4 |
| Epoxy Spray-on lining | 0.00 | 4 | 0.00 | 4 | 0.00 | 4 |

## Table 53. Discrete Compromise Method.

| Summary of Results | CP (0-1 Scale) |
|---|---|

| Alternatives | Group 1 Score | Group 1 Rank | Group 2 Score | Group 2 Rank | Group 3 Score | Group 3 Rank |
|---|---|---|---|---|---|---|
| Segmental Sliplining | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 |
| Continuous Sliplining | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 |
| Close-fit lining Deformed/Reformed | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 |
| Close-fit lining Fold and Form | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 |
| Spirally wound lining | 0.61 | 1 | 0.56 | 1 | 0.57 | 1 |
| Cured-in-place lining Inversion | 0.28 | 2 | 0.25 | 2 | 0.23 | 2 |
| Cured-in-place lining Pulled-in-place | 0.28 | 2 | 0.25 | 2 | 0.23 | 2 |
| Cement-mortar Spray-on lining | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 |
| Epoxy Spray-on lining | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 |

## Table 54. PROMETHEE Method.

| Summary of Results | PROMETHEE |
|---|---|

| Alternatives | Group 1 Score | Group 1 Rank | Group 2 Score | Group 2 Rank | Group 3 Score | Group 3 Rank |
|---|---|---|---|---|---|---|
| Segmental Sliplining | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 |
| Continuous Sliplining | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 |
| Close-fit lining Deformed/Reformed | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 |
| Close-fit lining Fold and Form | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 |
| Spirally wound lining | 0.32 | 1 | 0.26 | 1 | 0.29 | 1 |
| Cured-in-place lining Inversion | -0.02 | 9 | -0.08 | 9 | -0.04 | 9 |
| Cured-in-place lining Pulled-in-place | -0.02 | 9 | -0.08 | 9 | -0.04 | 9 |
| Cement-mortar Spray-on lining | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 |
| Epoxy Spray-on lining | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 |

It can be seen in Table 52, Table 53, and Table 54 that spirally wound lining is consistently the highest ranked alternative for both decision makers and in the scenario where all criteria are of equal weight.

**Summary**

Two (2) corrugated metal pipe culverts in the City of Coquitlam were rehabilitated in Kupskay's case study titled *Coquitlam Capital Works: B&B Relines Deep Culverts in Coquitlam Improvement Project.* One of the culverts, the Oneida Drive culvert, was considered in an example evaluation of the MCDA. Decision makers represented in the example were the City of Coquitlam and the residents of the neighborhood where the culvert rehabilitation was to take place. Priority for the City was theorized to be the cost of rehabilitation; residents were hypothesized to give precedence to flow bypass requirements due to the potential disruption to everyday life. In Kupskay's case study, the close-fit fold and form method was the chosen technique for culvert rehabilitation. The close-fit fold and form method was not considered in the MCDA process because this method is not considered to provide structural integrity to the rehabilitated culvert. Structural integrity was emphasized in the example due to loss of the ovality and deteriorated portions of the existing culvert. Comparison of the three (3) methods of alternative ranking consistently resulted in spirally wound lining as the best alternative for both decision makers.